COMP 411 — COMPUTER ORGANIZATION
Fall 2014

Lecture
TTh 2:00 PM – 3:15 PM Genome Sciences Building G-100

Lab
Th 3:30 PM – 4:45 PM Genome Sciences Building G-100

Don Smith (smithfd@cs.unc.edu)

http://www.cs.unc.edu/~smithfd/comp411-f14/

READ THIS HANDOUT CAREFULLY. YOU ARE RESPONSIBLE FOR KNOWING THE GROUND-RULES FOR THIS COURSE!

Course Overview

This course is an introduction to computer organization. Topics include digital logic, basic circuit components, data and instruction representation, computer architecture and implementation, and assembly language programming. Additionally, we'll provide an introduction to programming in C.

Prerequisite

COMP 401 ("Foundation of Programming").

Course Information

Instructor: Don Smith (smithfd@cs.unc.edu)
Brooks 312, 919-590-6184

Instructor Office Hours: TBA – we'll decide the first week of the semester by polling for your availability. I read email regularly (except for evenings and weekends when my email reading is sporadic); please use email for brief communications (appointments, etc.). ***When I am in my office, my door is almost always open and you are welcome to meet with me if I am alone***. You can always see me at regular office hours each week

Teaching Assistants: Office hours and phone numbers will be announced when the TAs are assigned.

Meetings: Class and Labs will meet in Genome Sciences Building G-100.

Texts:
Computer Organization and Design: The Hardware/Software Interface
Patterson and Hennessy

5th ed., 2014, ISBN 978-012-407726-3
(Note: the 4th edition, revised printing, used in 411 for Spring 2014 could be used instead).

C Programming Language
Kernighan and Ritchie
2nd ed. [paperback], Apr 1988, ISBN 978-0131103627

Software:

We will be using Unix (Linux), the C language and compiler, and a MIPS assembler and simulator. More on this in class.

Web page:
The course web page (just basic information) is at
http://www.cs.unc.edu/~smithfd/comp411-f14/
The contents are mostly this document and contact info.

Sakai:

Announcements and course material will be distributed on Sakai (sakai.unc.edu). It should appear on your workspace (within 24 hours if you recently added the course).

Piazza:

Please post questions (even private ones to instructor) on the discussion board on PIAZZA (https://piazza.com/unc/fall2014/comp411/home). The TAs and I will check it regularly. Enrollment notices will be emailed the first day of class.

Exams:

There will be one in-class mid-term exam and a final exam, plus a few quizzes.
The final exam is scheduled on Saturday, December 6, 2014, at 12:00 PM (noon).

Grading:

Problem Sets (4-5): 20%
Quizzes (4-5): 10%
Midterm Exam: 15%
Final Exam: 20%
Labs (10-12): 35%
Incompletes will be given only in dire emergencies such as illness or a family emergency. Documentation will be required.

Notes:

- There will be 4-5 problem sets.

- There will be 4-5 in-class or online quizzes, about 15 minutes in duration. The dates of these quizzes will be announced in advance.
- There will be a midterm and a final exam. The date of the mid-term will be announced in advance. The date and time for the final exam are set by the Registrar's calendar.
- There will be approximately 10-12 lab assignments.

Late policy:

There will be graded problem set and lab assignments. Each assignment will have a specific day and time deadline; late assignments will be penalized as follows:

- 1 day late (up to 24 hours after due date and time): 10% deduction
- 2 days late (24-48 hours after the due date/time): 25% deduction
- 3 days late (48-72 hours after the due date/time): 40% deduction
- 4+ days late (more than 72 hours after the due date/time): No assurance that assignment will be graded and at least 90% deduction only if submitted before the assignment solution is discussed in class no credit if submitted after the assignment solution is discussed in class

It is always better to turn in something, even if it is very late, than to turn in nothing. However, it is far better to work on the current assignment than to work on a past-due assignment.

Honor Code See http://honor.unc.edu

The Honor Code is in effect in this class, as in all others at the University. The Honor System's "Honor in the Syllabus" page includes the following suggested "affirmation of the Honor Code":

The University of North Carolina at Chapel Hill has had a student-administered honor system and judicial system for over 100 years. The system is the responsibility of students and is regulated and governed by them, but faculty share the responsibility. If you have questions about your responsibility under the honor code, please bring them to your instructor or consult with the office of the Dean of Students or the Instrument of Student Judicial Governance. This document, adopted by the Chancellor, the Faculty Council, and the Student Congress, contains all policies and procedures pertaining to the student honor system. Your full participation and observance of the honor code is expected.

We (the TAs and I) are very serious about the honor code. While it's easy to cheat in this course, it's also very easy for us to detect plagiarism. So don't do it! You are encouraged to work together for better understanding of the course material and assignment requirements, but do the actual coding or problem solutions by yourself. Too much reliance on others can be disastrous at exam time.

You are free to use any code that was presented in class, in labs or other help sessions, with attribution (in the comments). You may NOT use code that you found on the web, or

material from previous offerings of this course. Note: The Honor Code applies to posts on PIAZZA.

Course Contents:

Introduction (0.5 week)
Performance (1 week)
- Latency and Throughput
- Amdahl's Law

Representing Data and Instructions (3 weeks)
- Information Encoding
- Instruction Sets
- Addressing Modes

Programming in Assembly Language (2 weeks)
- Assembly Language
- Function/Procedure Calls and Stacks
- Assemblers and Compilers

Basics of Logic Implementation (1 week)
- Transistors
- Basic Logic Gates
- Truth Tables and Boolean Synthesis

Arithmetic Circuits (3 weeks)
- Addition and Subtraction
- Shifting and Logical Operations
- A Complete ALU
- Multiplication and Division
- Floating-Point Arithmetic

Control and Execution (2 week)
- Finite State Machines
- Five Stages of Execution
- A Complete CPU

Memory (1 week)
- RAM/ROM Organization
- Memory Hierarchy
- Caches and Virtual Memory

Pipelining (1 week)
- Pipeline Basics
- Two-, Four-, and Five-Stage Processor Pipelines
- Structural, Data, and Branch Hazards
- Performance Impact

Operating System and I/O (0.5 week)
- Basics of OS and I/O